CLAIMS:

1. A thrust load enhancement device for a rotor-bearing system comprising:

a stator mounted on a rotation axis of the rotor-bearing system;

a rotor separated from said stator by a first air gap on the rotation axis; and

at least one permanent magnet separated from said rotor by a second air gap,

wherein said at least one permanent magnet, said stator and said rotor form a magnetic circuit characterized by a flux path so that a flux in said first and second air gaps generates a compensation force between said rotor and said stator that opposes an external force F_{ext}.

2. The thrust load enhancement device according to claim 1, wherein the external force F_{ext} is caused by an action selected in the group comprising pressure and gravity in a vertical shaft configuration wherein a center of gravity is low.

3. The thrust load enhancement device according to claim 1, wherein said at least one permanent magnet is fixed to said stator.

4. The thrust load enhancement device according to claim 1, wherein said at least one permanent magnet is fixed to said rotor.

5. The thrust load enhancement device according to claim 1, wherein a first one of said at least one permanent magnet is fixed to said stator and a second one of said at least one permanent magnet is fixed to said rotor.

6. The thrust load enhancement device according to claim 5, wherein said first one of said at least one permanent magnet and said second one of said at least one permanent magnet respectively have poles of different polarity facing each other to create an attractive compensation force between said rotor and said stator.

7. The thrust load enhancement device according to claim 5, wherein said first one of said at least one permanent magnet and said second one of said at least one permanent magnet respectively have poles of a similar polarity facing each other to create an expulsion compensation force between said rotor and said stator.

8. The thrust load enhancement device according to any one of claims 1 to 7, further comprising a spacer to adjust said first and second air gaps.

9. The thrust load enhancement device according to any one of claims 1 to 7, further comprising a piezoelectric actuator mounted in said stator.

10. The thrust load enhancement device according to any one of claims 1 to 9, wherein said rotor and said stator are made in a material selected in the group comprising a soft magnetic material and a non-magnetic material.

11. The thrust load enhancement device according to any one of claims 1 to 9, wherein said rotor is made of carbon steel and said stator is made of mild steel.

12. The thrust load enhancement device according to any one of claims 1 to 11, wherein the external force is selected in the group comprising a static force and a dynamic force.

13. The thrust load enhancement device according to any one of claims 1 to 12, further comprising force measurement devices to measure the compensation force.

14. The thrust load enhancement device according to 13, wherein said force measurement devices are selected in the group comprising stain gauges and piezoelectric elements.

15. The thrust load enhancement device according to any one of claims 1 to 14, wherein said load enhancement device is located at one end of a shaft of the rotor-bearing system.

16. The thrust load enhancement device according to any one of claims 1 to 15, wherein the thrust load is unidirectional from an external working load.

17. The thrust load enhancement device according to any one of claims 1 to 15, wherein the thrust load is unidirectional from a rotor weight in a vertical configuration.

18. The thrust load enhancement device according to any one of claims 1 to 11, wherein the external force is an unidirectional external static load selected in the group comprising a working load and a shaft weight in a vertical configuration.

19. The thrust load enhancement device according to any one of claims 1 to 18, wherein the rotor-bearing system is selected in the group comprising a magnetic bearing system, a hydrostatic bearing system, a hydrodynamic bearing system, and a rolling element bearing system.

20. A method for thrust load enhancement for a rotor-bearing system comprising the steps of:

providing a stator on a rotation axis of the rotor-bearing system;

providing a rotor separated on the rotation axis from the stator by a first air gap; and

providing at least one permanent magnet separated from the rotor by a second air gap,

whereby the at least one permanent magnet, the stator and the rotor form a magnetic circuit characterized by a flux path so that a flux in the first and second air gaps generates a compensation force between the rotor and the stator that opposes an external force $F_{ext.}$

21. The method for thrust load enhancement according to claim 20, wherein said steps of providing a stator and said step of providing a rotor comprise providing a rotor and a stator made in a material selected in the group comprising a soft magnetic material and a non-magnetic material.

22. The method for thrust load enhancement according to claim 20, wherein said step of providing a stator comprises providing a stator made of mild steel and said step of providing a rotor comprises providing a rotor made of carbon steel.

23. The method for thrust load enhancement according to claim 20, wherein said step of providing at least one permanent magnet comprises mounting at least one permanent magnet on the stator.

24. The method for thrust load enhancement according to claim 20, wherein said step of providing at least one permanent magnet comprises mounting at least one permanent magnet on the rotor.

25. The method for thrust load enhancement according to claim 20, wherein said step of providing at least one permanent magnet comprises fixing a first one of the at least one permanent magnet to the stator and a second one of the at least one permanent magnet to the rotor.

26. The method for thrust load enhancement according to claim 25, wherein said steps of fixing a first one of the at least one permanent magnet to the stator and a second one of the at least one permanent magnet to the rotor comprise arranging respective poles of different polarity thereof facing each other to create an attractive compensation force between the rotor and the stator.

27. The method for thrust load enhancement according to claim 25, wherein said steps of fixing a first one of the at least one permanent magnet to the stator and a second one of the at least one permanent magnet to the rotor comprises arranging respective poles of similar polarity facing each other to create an expulsion compensation force between the rotor and the stator.

28. The method for thrust load enhancement according to any one of claims 20 to 27, further comprising a step of providing a spacer to adjust said first and said second air gaps.

29. The method for thrust load enhancement according to any one of claims 20 to 27, further comprising the step of mounting a piezoelectric actuator in the stator.

30. The method for thrust load enhancement according to any one of claims 20 to 29, wherein the external force is selected in the group comprising a static force and a dynamic force.

31. The method for thrust load enhancement according to any one of claims 20 to 30, further comprising the step of providing force measurement devices to measure the compensation force.

32. The method for thrust load enhancement according to 31, wherein said step of providing force measurement devices comprises selecting devices in the group comprising stain gauges and piezoelectric elements.

33. The method for thrust load enhancement according to any one of claims 20 to 32, wherein the rotor-bearing system is selected in the group comprising a magnetic bearing system, a hydrostatic bearing system, a hydrodynamic bearing system, and a rolling element bearing system.